DOCUMENT RESUME

ED 241 257 SE 041 793

AUTHOR	Oxberger, Nancy; And Others
TITLE	"Think More about Thinking": Activities and Games That Stress the Process of Problem Solving Utilizing Techniques Which Employ Strategic Thinking. (Grades 2-6.) Title I Elementary Mathematics Program.
INSTITUTION	Des Moines Public Schools, Iowa.
PUB DATE	79
NOTE	26p.; Games and problems on pages 4 and 20-21 have been removed due to copyright restrictions.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Cognitive Processes; Educational Games; Elementary Education; *Elementary School Mathematics; Geometric Concepts; Learning Activities; *Logical Thinking; *Mathematical Logic; Mathematics Instruction; Number Concepts; Pattern Recognition; *Problem Solving
IDENTIFIERS	Elementary Secondary Education Act Title I; PF Project

ABSTRACT

Games and activities which involve problem solving are presented in order to help teachers develop the numeric, geometric, and logical thought processes of elementary school students. The activities and games (many of which are pencil-and-paper) require using logic, plan-ahead strategies, spatial reasoning, strategies based on prior patterns or experience, or some combination of these. Instructions and materials are provided for seven games, most of which involve two players, and for 10 problem-solving activities which can be done individually. (DC)

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Think MORE ABOUT Thinking!

Thoughts About Problem Solving

SE041793

DES MOINES INDEPENDENT SCHOOL DISTRICT

1800 Grand Avenue

Des Moines, Iowa 50307

"THINK MORE ABOUT THINKING"

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Sherry Sollenbarger
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Activities and Games that stress the process of problem solving utilizing techniques which employ strategic thinking. (Grades 2 - 6)

Title I Elementary Mathematics Program

1979

THINK MORE ABOUT THINKING

THINK ACTIVITIES: WHAT AND WHY

As mathematics educators we must and can assist students thought processes in all areas: numeric, geometric, and logical. School classroom environments should provide readily available opportunities to engage in mathematical thought, in puzzling, in trial and error, in inquiry, in short -- in problem solving. Our emphasis is too often on right answers, getting numbers in the box, and the development of basic skills.

A THINK ACTIVITY is one in which luck is only a minor factor. It may involve logic, a plan-ahead strategy, spatial reasoning, building strategies based on prior patterns or experience, or some combination of these. Many think activities and think games only require pencil and paper. In most, there is imbedded a spirit of what mathematics is truly about. The activities compiled here all have the common goal of stimulating and encouraging logical thought in fun and interesting formats.

Pico - Fumi

One player picks any 3-digit number with no number repeating (505, 212, 337, etc.) His opponent randomly selects any 3-digit number to begin guessing. Clues are then given to each number the opponent chooses. Pico is the response if the 3-digit number guessed has a number in the same place as the number chosen by his opponent. Two picos are given if 2 numbers are in correct place. A three pico response would indicate that the player had selected his opponent's number, thus winning the game. A Fumi clue means the player has selected a correct number of the 3-digit number but in the wrong place. One can respond with one, two, or three Fumis. From the clues, the opponent wants to arrive at the original number in the least amount of guesses.

A sample game follows:

Number selected (369)

Opponents Guesses	Response, Result
142	No response
503	F
576	F
975	F
769	PP
765	P
165	P
369	PPP

PICO-FUMI

Code Number:			
Guesses	Responses	Guesses	Responses

Player A Player B

Code Number:			
Guesses	Responses	Guesses	Responses

Pico - Number in Correct place Fumi - Correct number wrong place,

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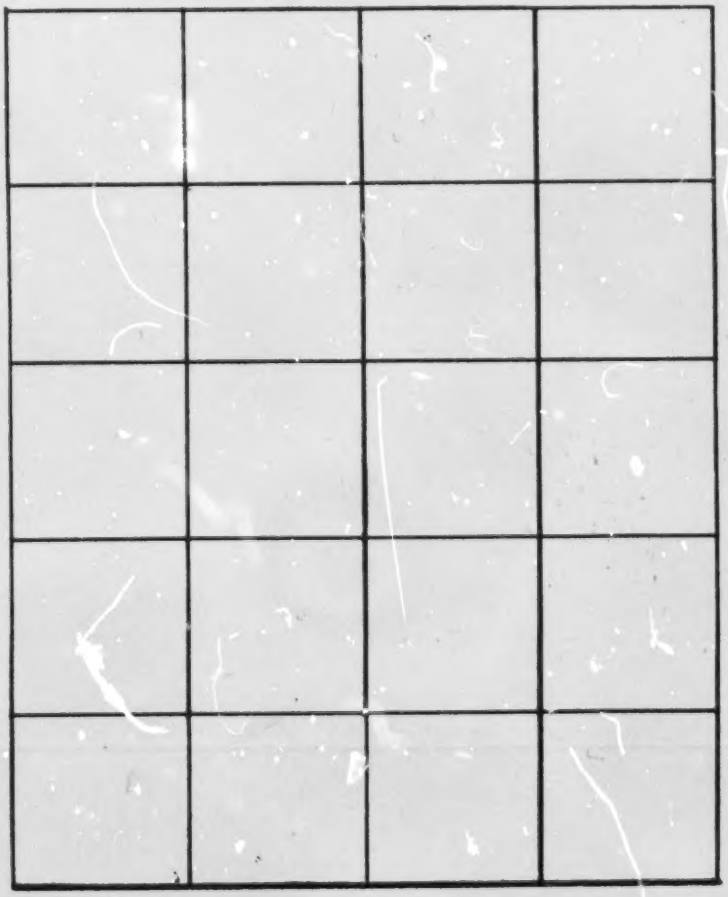
REVERSE TIC TAC TOE

Strategic Thinking

Object: To avoid placing three of your marks in a row.

Game is played as tic tac toe except that you try to avoid placing three of your marks in row.



4 x 5 Grid

DOTS AND SQUARES

This one man strategy game is played on a board of 4 rows of dots evenly spaced, 5 dots to a row.

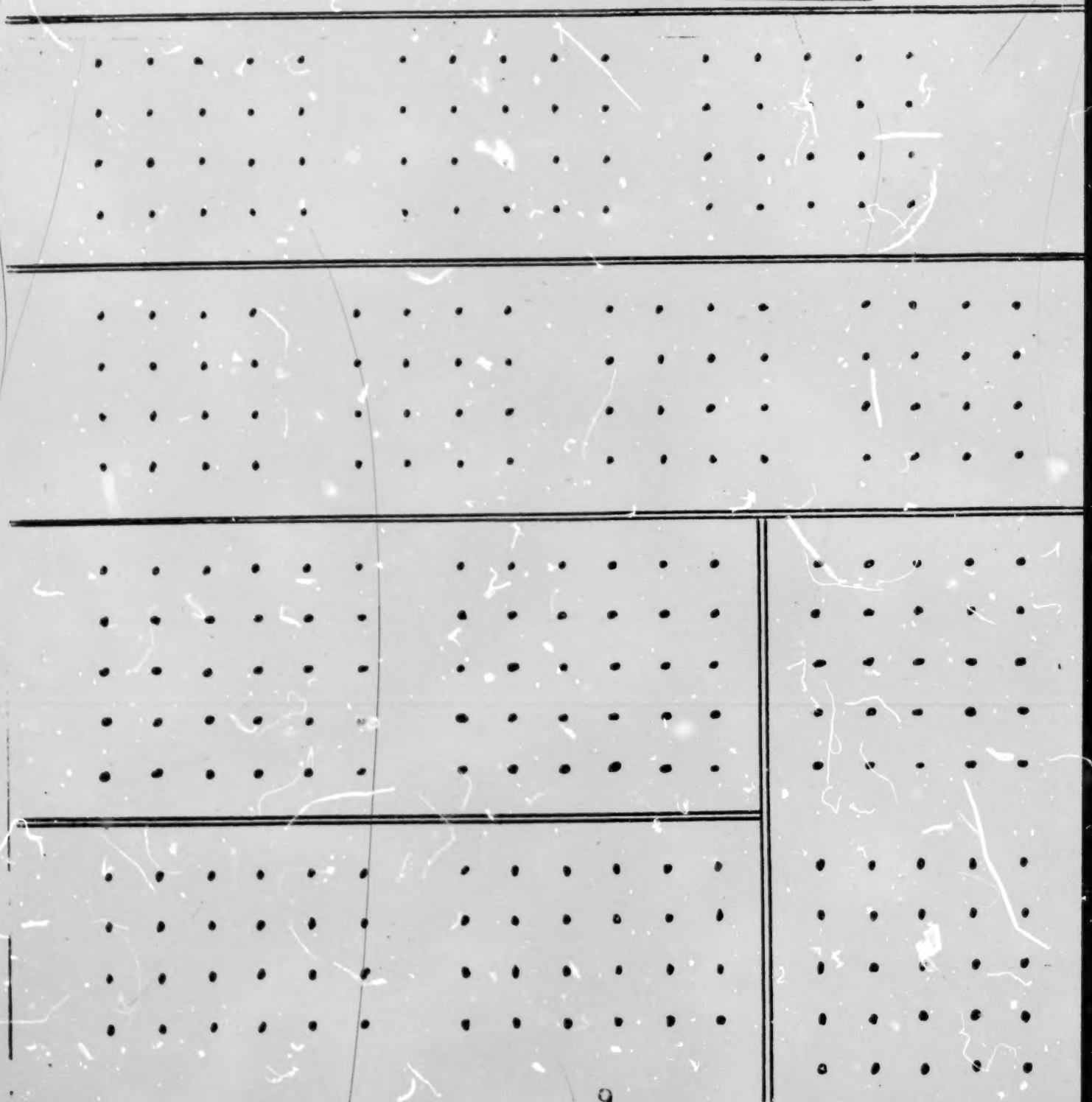
Start anywhere and connect dots by straight lines trying to form as many squares as possible. The marker may not be lifted from the board and no line may be crossed or retraced. When finally no more lines can be played, the score is determined as follows.

Full Squares	4		1
3 sides	3		3/4
2 sides	2	or	1/2
1 side	1		1/4

Use the fractional scoring for students who are capable of adding halves and fourths. Use the whole number scoring system for primary children.

Try playing dots and squares on other dot arrays such as 4 x 4 or 5 x 6.

DOTS and SQUARES



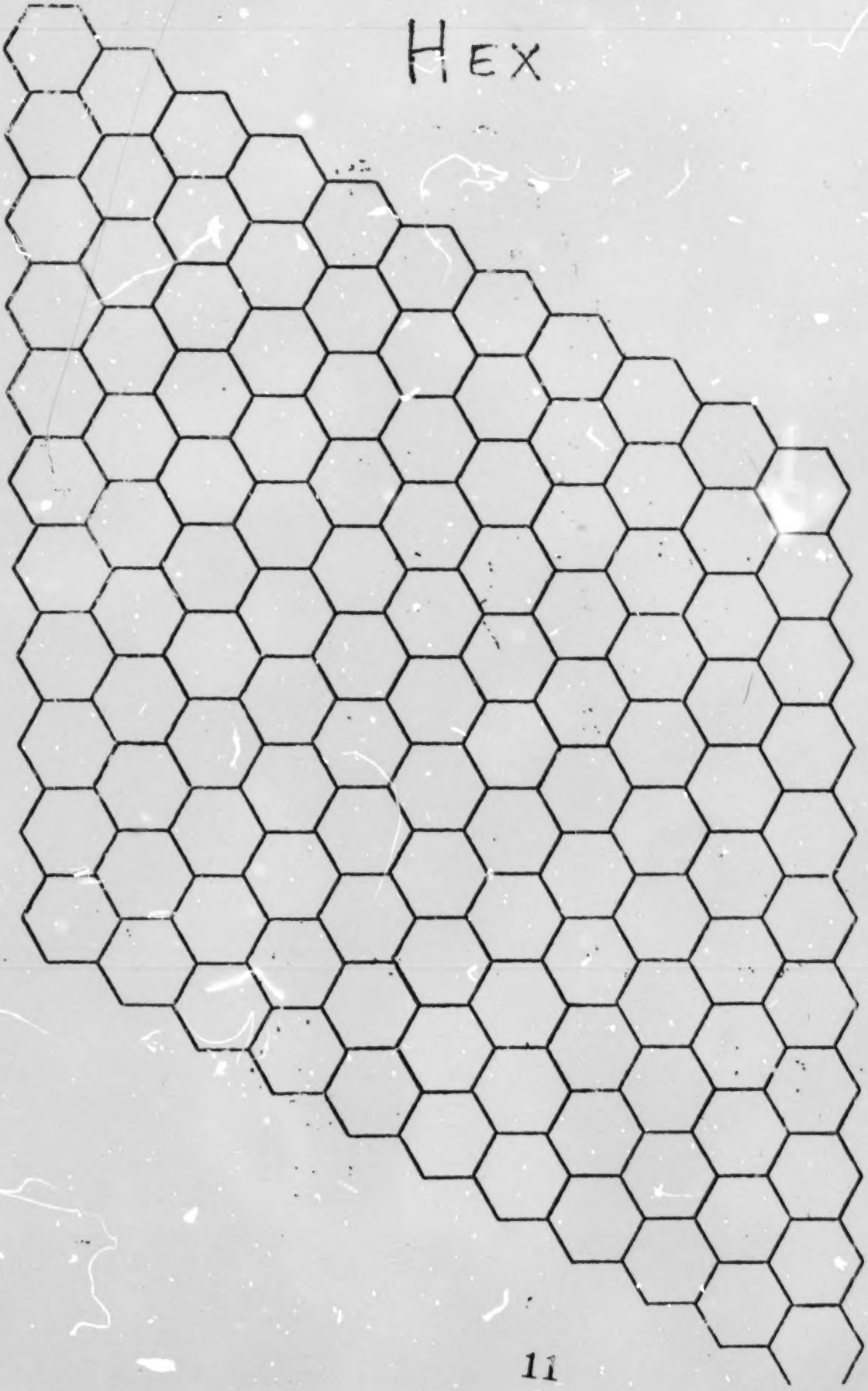
HEX

To Begin:

Players simply use initials to place in hexagons, beginning anywhere on the board. To win, the players must form a connecting trail of initials from opposite sides (north, south, east, west).

After playing Hex, the students will begin to form strategies to develop winning skills.

HEX



POISON

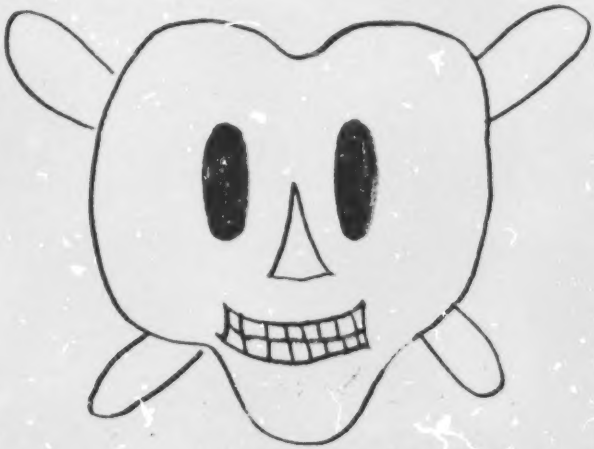
This game for two players is frequently called "Nim" and has lots of variations to keep interest high.

To start, place six counters on each of the three sections of the game board. (The board is optional but adds interest to the game.) Players take turns removing counters from the board. Any number of counters may be removed on each turn but they must be taken from only one pile per turn. That is, on a given turn a player may not take counters from two different piles. Any amount from one counter to all that are left in the pile may be removed in one turn.

The last counter left on the board is "poison". Thus, the object of the game is to force the other player to take the last, poison counter.

The game can be varied by putting more or less markers in the loops. Not all sections need have the same amounts to start. The game is also varied by changing the number of piles. In a one pile game a restriction must be made on the number of counters removed. For example, start with twenty counters and remove no more than 5 counters on a given turn.

POISON



"NUMBER NO-JUMP"

Use 5 x 5 grid paper.

Grades 2 - 6

3	8	5		4
2		15		1
17		16	12	11
18	9	14	13	10
19	7	6		

Rules:

1. Two players take turns entering numerals on the grid, starting at "1" and continuing in numerical order.

2. First player may place his "1" anywhere. Each number then must be entered in either the same row or column (not diagonal) as the number preceding it.

3. A player may not "jump over" a previous entry. For example, the 4, in the sample game, could be placed only in the same row as the 3, not the same column as the 2, which would have required jumping over the 2.

4. Play continues until one player can no longer move. The player who writes the last number adds that number to his score. In this game, the player scored 19, since the other player could not place 20 anywhere.

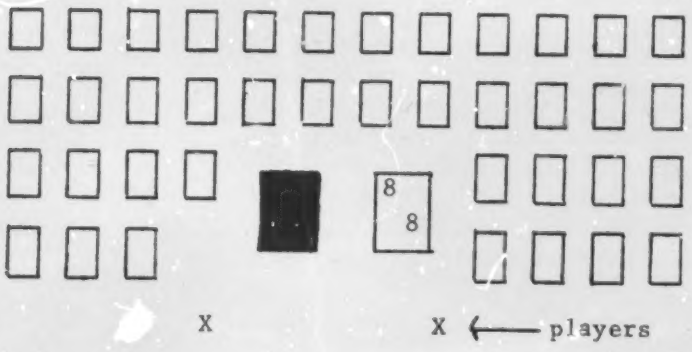
5. Either player is permitted to resign his turn without entering a number; his opponent then scores his last entry. This helps when a player finds himself in a losing position.

POKE - A - DOTS

Cards -------- Set of dotted ---- 60 cards -Black dots from 1-15 (4 of each)
Set of numbers --- 45 cards -From 1-15 (3 of each)
(Use Flinch Sets from Strings and Things)
Players------- Two. They sit or stand side-by-side.
Shuffle both sets of cards (once shuffled well, they will require little shuffling for future games).

Place dotted cards face up on the playing surface but leave a clear section next to and between the players large enough for two stacks of numbered cards.

(Plus rest of dotted cards)



Cut for who is to play first. Player with highest number starts.
Start by turning top card up. Example: If the card is an 8, the player who can find a card with eight black dots first places his finger on that card and calls out "Poke." Other player checks to be sure there are 8 black dots.

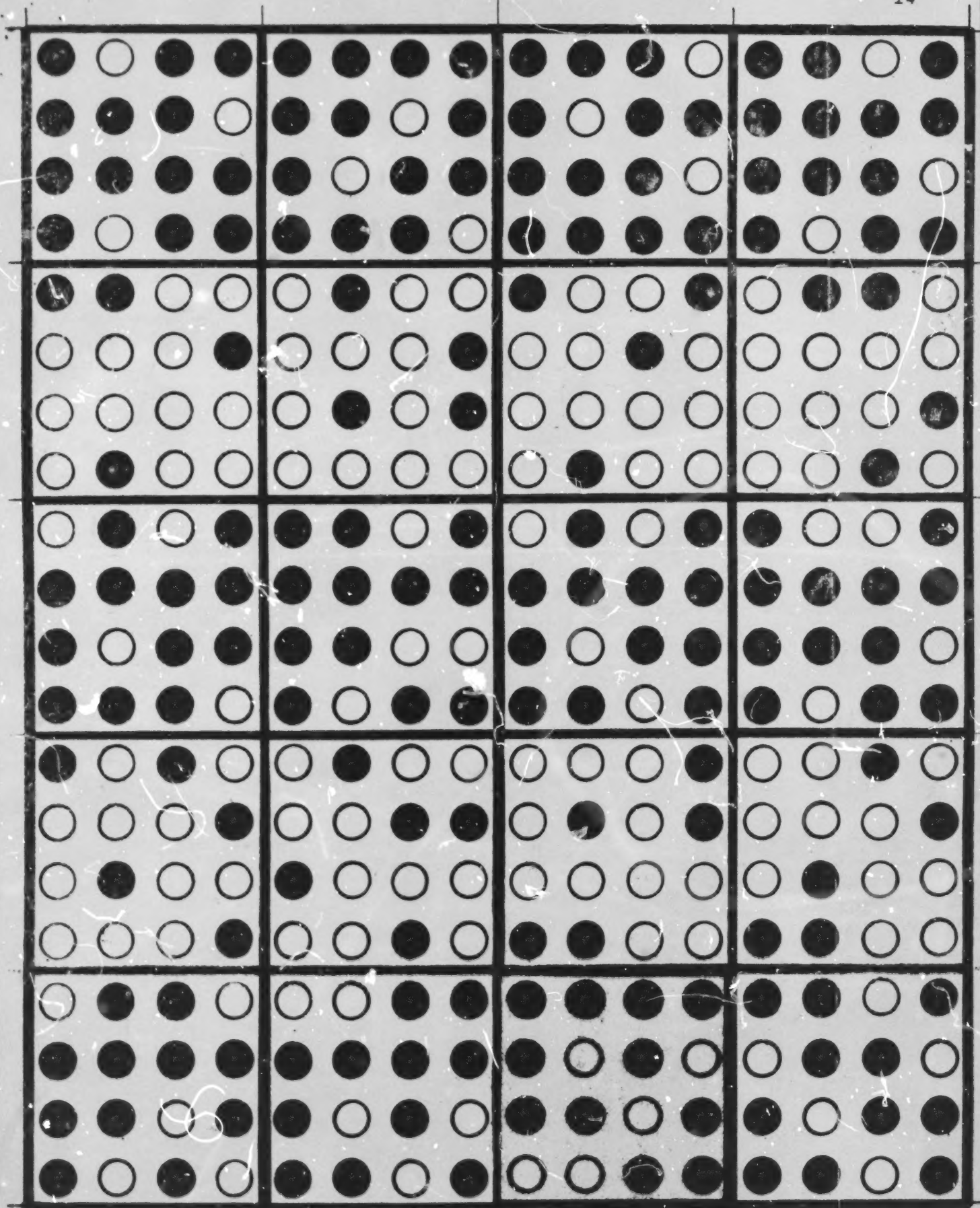
a. If "Poke" was correct he or she picks up both the dotted card and the numbered card and lays them over on his or her side.
b. If "Poke" was wrong the dotted card is replaced and the other player can take time to find an 8 card and then place the two cards to his or her side.

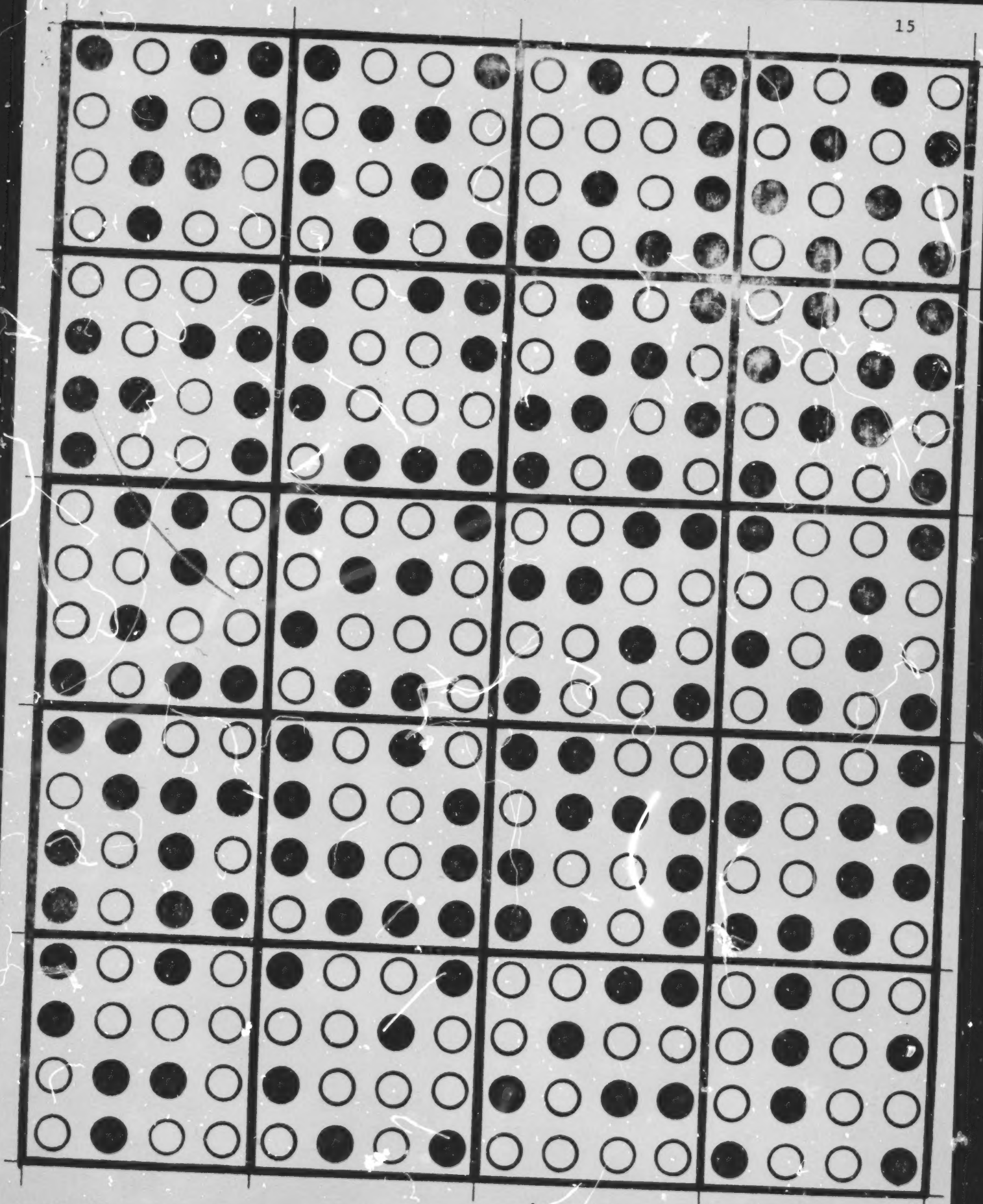
The player who earns the two cards gets to turn up the next number card.
If not sure who called "Poke" first, replace that number card somewhere in the deck and draw a new one.
At the end of the game there should be 15 dotted cards left (1-15). The player who has the most cards at the end of the game wins. (Count only one set of cards; that is either the dotted or the numbered.)

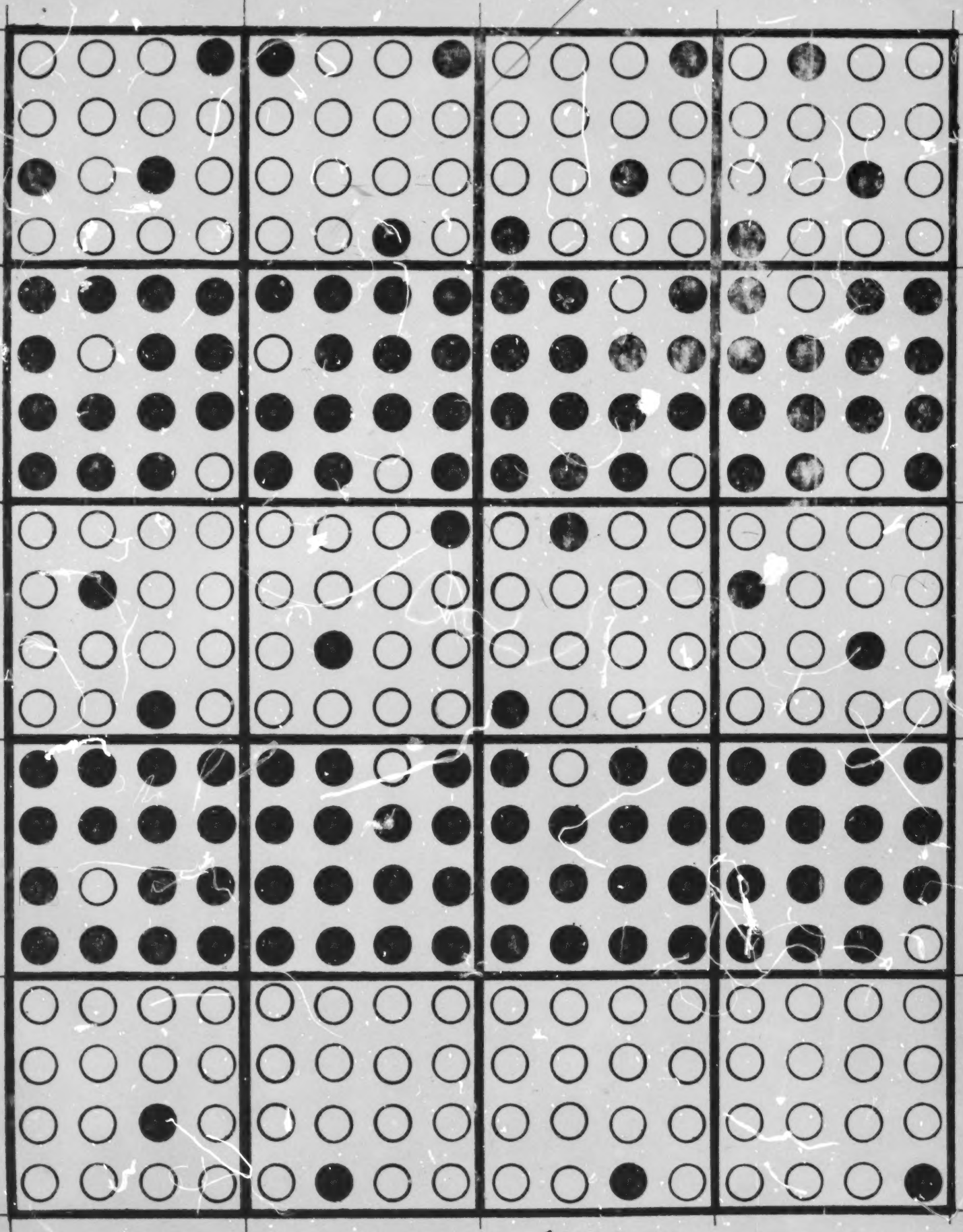
Strategy - with young children may have to call attention to

1. There are 16 dots on each card. If the number is 8 half the dots will be black, half white.
2. In counting the dots try to see them in groups and then add. (Number is 6, 2 groups of 3 or a group of 2 and a group of 4, etc.)
3. With large numbers count white dots instead of black. (Number is 13 [16-13 = 3] look for a card with 3 white dots.)

by: Betty Hazard

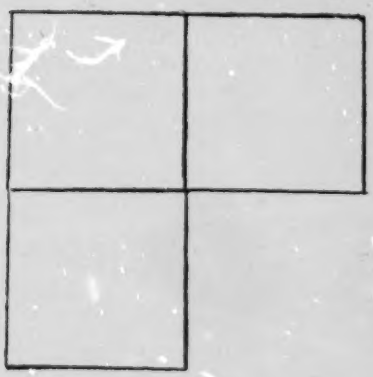






Arrange the squares so that they join along a side. Use the inch squares. Color your arrangements on graph paper. Use the chart below to show how many ways you found.

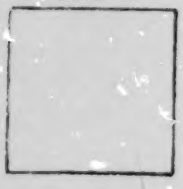
Example:



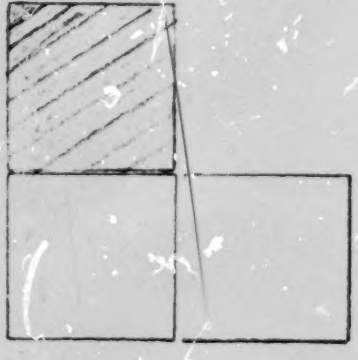
Number of Squares	3	4	5	6	7	8
Number of Arrange-ments						

BUILDING STAIRS

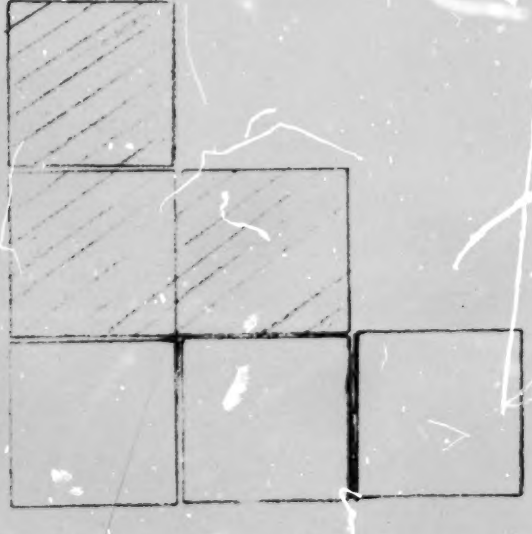
Stair 1



Stair 2



Stair 3

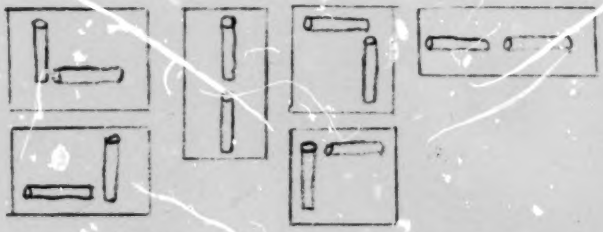


Perimeter	Area
4	1
8	1+2=3
?	?

Build stairs 4 through 10. What patterns can you find?

HOW MANY SMITCHES?

These are two-stick Smitches:



How many three-stick Smitches can you make: Use the sticks to make them. Record how many you found. Make Smitches using 4, 5, 6, 7, or 8 sticks.

Record how many!	
Number of Sticks	Num. of Smitches
2	
3	
4	
5	
6	
7	
8	

To the teacher

Materials needed: Straws (or toothpicks or match sticks), recording sheet.

Directions: The sticks are to be placed end-to-end or at right angles. Younger students can be allowed to use rotations. Older students could be required not to use rotations. Older students could also make predictions for 10 sticks, 200 sticks, etc.

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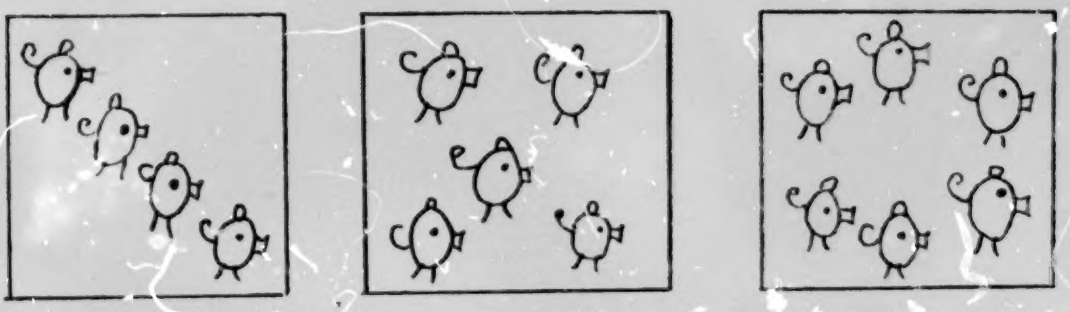


DRAW 3 LINES SO THAT EACH PIG IS ALONE IN A PEN.

(Could use a string).

NAME THE NEXT 4 LOCKERS.

WHERE IS LOCKER 73?

How many ways can you have 15¢? (25¢, 78¢, $1.00)

(Ideally, the students will build an organized list and discover a pattern).

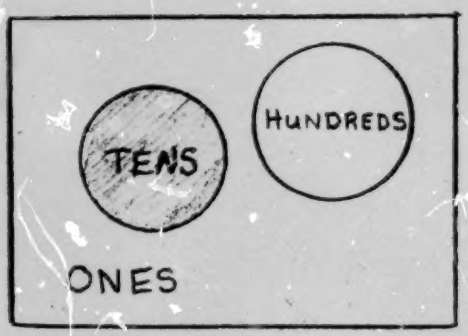
TARGET GAME

Score 56

Where are the shots?

Score 122

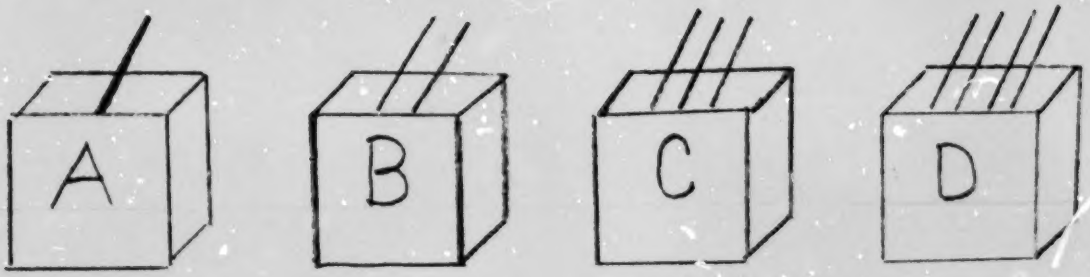
Where are the shots?



"HOW MANY WAYS?"

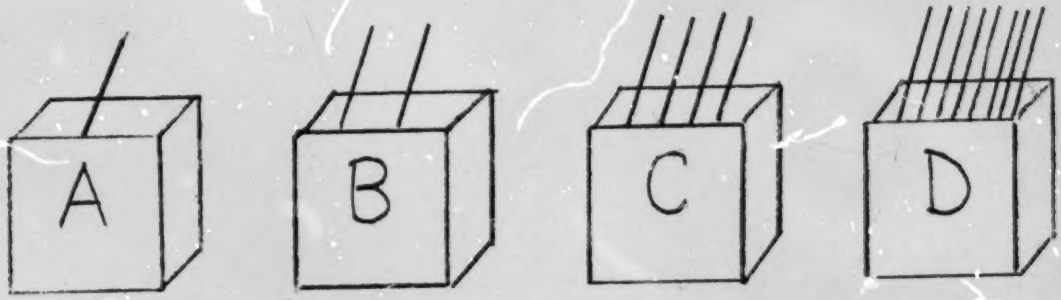
2 Plates - 7 Beans

Child should record as he manipulates the beans.



How many sticks in box J?

Which box has 18 sticks?



How many sticks in box E?